

adopted value for 1750-1815 was $15' 34''\cdot27$; for 1816-39 it was $15' 33''\cdot95$; for 1840-61 it was $15' 34''\cdot68$; and in and after 1862 it was $15' 34''\cdot08$. The present (1900) value used in the *Nautical Almanac* is $15' 34''\cdot09$, the mean horizontal parallax being $57' 2''\cdot28$.

In the Preface to the *Nautical Almanac* for 1897 there appeared, for the first time, special values of the semidiameters of the Sun and Moon for use in eclipses and occultations, the value for the Sun being $15' 59''\cdot63$ (Auwers), and for the Moon $15' 32''\cdot65$ (Struve). For 1900 the American Ephemeris adopts $15' 31''\cdot76$ for the eclipse semidiameter of the Moon.

There seems to be but little doubt that we need to use *three* different values for the Moon's semidiameter; the largest value for ordinary telescopic purposes, the intermediate for the occultations of stars, and the smallest for solar eclipses.

I would draw the attention of those interested in this subject to a very able article by Professor Oudemans, published in the *Monthly Notices*, vol. xxvi. pp. 249-260, 1866 May. He therein discusses the duration of occultations and eclipses, refers to the effect of indentations on the Moon's limb, and draws the conclusion that for occultations the Moon's mean semidiameter is $15' 32''\cdot27$, but that for eclipses it is only $15' 31''\cdot02$. The difference $1''\cdot25$ between these values agrees very nearly with the difference $1''\cdot18$ between the *Nautical Almanac* value, $15' 32''\cdot65$, and that recently deduced by Herr Peters, $15' 31''\cdot47$.

I am much indebted to Mr. Crommelin for independent confirmation of the principal computations in this paper.

Leeds: 1901 December.

Mean Areas and Heliographic Latitudes of Sun Spots in the Year 1901, deduced from Photographs taken at the Royal Observatory, Greenwich, at Dehra Dûn (India), and in Mauritius.

(Communicated by the Astronomer Royal.)

The results here given are in continuation of those printed in the *Monthly Notices*, vol. lxi. p. 533, and are deduced from the measurements of photographs taken at the Royal Observatory, Greenwich, at Dehra Dûn, India, and at the Royal Alfred Observatory, Mauritius.

Table I. gives the mean daily areas of umbrae, whole spots, and faculae for each synodic rotation of the Sun in 1901; and Table II. gives the same particulars for the entire year 1901 and the twelve preceding years for the sake of comparison. The areas are given in two forms: first, projected areas, that is to

say, as seen and measured on the photographs, these being expressed as millionths of the Sun's apparent disc; and next areas as corrected for foreshortening, the areas in this case being expressed in millionths of the Sun's visible hemisphere.

Table III. exhibits for each rotation in 1901 the mean daily area of the whole spots, and the mean heliographic latitude of the spotted area, for spots north and for spots south of the equator; together with the mean heliographic latitude of the entire spotted area, and the mean distance from the equator of all spots; and Table IV. gives the same information for the year as a whole, similar results from 1889 to 1900 being added, as in the case of Table II. Tables II. and IV. are thus in continuation of the similar tables for the years 1874 to 1888 on pp. 381 and 382 of vol. xlix. of the *Monthly Notices*.

The rotations in Table I. and Table III. are numbered in continuation of Carrington's series (*Observations of Solar Spots made at Redhill* by R. C. Carrington, F.R.S.), No. 1 being the rotation commencing 1853 November 9. The assumed prime meridian is that which passed through the ascending node at mean noon of 1854 January 1, and the assumed period of the Sun's sidereal rotation is 25·38 days. The dates of the commencement of the rotations are given in Greenwich civil time, reckoning from mean midnight.

TABLE I.

No. of Rotation.	Date of Commencement of each Rotation.	No. of Days on which Photographs were taken.	Mean of Daily Areas.					
			Projected.			Corrected for Foreshortening.		
			Umbrae.	Whole Spots.	Faculae.	Umbrae.	Whole Spots.	Faculae.
632	1900. d Dec. 24·64	26	0·0	0·5	0·0	0·0	0·3	0·0
633	1901. Jan. 20·98	27	2·4	8·0	13	1·9	6·6	16
634	Feb. 17·32	26	6·9	22	29	5·0	16	36
635	Mar. 16·65	26	0·0	0·0	7·0	0·0	0·0	9·8
636	Apr. 12·93	27	0·0	0·0	0·0	0·0	0·0	0·0
637	May 10·18	28	138	339	53	83	231	72
638	June 6·39	27	14	70	34	8·8	46	42
639	July 3·59	27	0·0	0·9	47	0·0	1·1	54
640	July 30·80	25	0·0	0·0	6·2	0·0	0·0	6·6
641	Aug. 27·03	28	0·0	0·4	2·2	0·0	0·3	3·2
642	Sept. 23·29	27	2·5	10	8·1	1·4	5·4	7·1
643	Oct. 20·58	27	5·2	29	94	5·5	31	130
644	Nov. 16·88	27	9·7	51	4·0	6·4	35	7·7

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TABLE II.

Year.	No. of Days on which Photo-graphs were taken.	Mean of Daily Areas.					
		Projected			Corrected for Foreshortening.		
		Umbræ.	Whole Spots.	Faculæ.	Umbræ.	Whole Spots.	Faculæ.
1889	360	17.9	103	107	13.1	78.0	131
1890	361	21.3	133	273	15.5	99.4	304
1891	363	120	745	1322	86.2	569	1412
1892	362	255	1596	3230	186	1214	3270
1893	362	327	1983	2287	234	1464	2404
1894	364	317	1728	1666	231	1282	1877
1895	364	237	1330	2059	169	974	2278
1896	364	127	745	1243	90	543	1410
1897	364	122	695	977	88	514	1149
1898	363	93	532	767	64	375	891
1899	364	27	159	297	18	111	337
1900	360	22	101	150	17	75	180
1901	359	14	41	23	8.6	29	29

TABLE III.

No. of Rotation.	Date of Commence-ment of each Rotation.	No. of Days on which Photo-graphs were taken.	Spots North of the Equator.		Spots South of the Equator.		Mean Heliographic Latit-ude of Entire Spotted Area.	Mean Distance from Equator of all Spots.
			Mean of Daily Areas.	Mean Heliographic Latitude.	Mean of Daily Areas.	Mean Heliographic Latitude.		
632	1900. d Dec. 24.64	26	0.0	...	0.3	10.20	- 10.20	10.20
633	1901. Jan. 20.98	27	0.0	...	6.6	8.20	- 8.20	8.20
634	Feb. 17.32	26	15	3.71	1.2	4.95	+ 3.04	3.81
635	Mar. 16.65	26	0.0	...	0.0	...	...	...
636	Apr. 12.93	27	0.0	...	0.0	...	...	...
637	May 10.18	28	231	8.66	0.0	...	+ 8.66	8.66
638	June 6.39	27	38	9.69	8.6	19.48	- 4.30	11.55
639	July 3.59	27	0.1	2.10	1.0	1.68	- 1.17	1.73
640	July 30.80	25	0.0	...	0.0	...	...	...
641	Aug. 27.03	28	0.3	36.37	0.0	...	+ 36.37	36.37
642	Sept. 23.29	27	0.0	...	5.4	8.85	- 8.85	8.85
643	Oct. 20.58	27	0.0	...	31	14.91	- 14.91	14.91
634	Nov. 16.88	27	0.0	...	35.0	20.21	- 20.21	20.21

TABLE IV.

Year.	No. of Days on which Photographs were taken.	Spots North of the Equator.		Spots South of the Equator.		Mean Heliographic Latitude of Entire Spotted Area.	Mean Distance from Equator of all Spots.
		Mean of Daily Areas.	Mean Heliographic Latitude.	Mean of Daily Areas.	Mean Heliographic Latitude.		
1889	360	5.0	7.26	73.0	11.90	- 10.68	11.61
1890	361	53.1	22.20	46.3	21.75	+ 1.73	21.99
1891	363	401	20.49	169	19.91	+ 8.52	20.31
1892	362	607	15.09	607	21.69	- 3.29	18.39
1893	360	517	14.91	941	14.26	- 3.93	14.49
1894	364	543	12.31	739	15.56	- 3.75	14.18
1895	364	565	14.26	409	12.54	+ 3.01	13.54
1896	364	203	13.60	340	14.77	- 4.15	14.33
1897	364	196	8.32	318	7.73	- 1.62	7.96
1898	363	110	9.82	266	10.77	- 4.75	10.49
1899	364	23	6.18	88	10.43	- 6.95	9.54
1900	360	26	6.61	49	8.34	- 3.12	7.74
1901	359	22	8.59	6.6	16.27	+ 2.82	10.37

The principal features of the record for 1901 are :—

1. The decline in area of umbræ, whole spots, and faculæ has still continued, and has been most marked ; the relative decrease in mean daily spotted area for 1901 as compared with 1900 being greater than for 1900 as compared with 1899.

2. The decrease in the area of the umbræ has been proportionally less than that for the whole spots.

3. The decrease in the area of the faculæ on the other hand has been very remarkable. The area registered—twenty-nine millionths—is by far the lowest for any year of the Greenwich solar record, the next lowest being ninety millionths for 1878.

4. Except for a single outburst the northern hemisphere has been practically quiescent for the entire year. But that outburst was so much the greatest that it contributed, in its two appearances, 74 per cent. of the entire spotted area of the year, and in consequence of it the mean daily area for the northern hemisphere was more than three times as great as for the southern.

5. Comparing 1901 with 1900 the decrease for the northern hemisphere was only 15 per cent., whilst for the southern it was 86 per cent. The decrease, therefore, has been almost entirely in the southern hemisphere.

6. The only notable outburst of the year was the group referred to above. This was seen first on the east limb on May 19, the morning after the total solar eclipse of May 18. At the times of the eclipse as seen in Mauritius and Sumatra

respectively the centre of the group was 93° and 92° distant from the central meridian, and therefore only just out of sight behind the east limb. The group was situated in N. lat. 9° , and a fine prominence is seen in the Mauritius photographs of the eclipse, rising from the limb in N. lat. 6° , *i.e.* just over the southern end of the spot group. A comparison of the Mauritius and Sumatra eclipse photographs shows that a considerable change has taken place in the form of this prominence in the interval of about 100 minutes which separated the two series of observations. To the north of the prominence, and therefore directly over the spot group itself, the corona is seen on both series of photographs as much disturbed.

The spot group appeared a second time on the east limb on June 16, but had diminished in size, almost to disappearance, before it reached the west limb on June 26.

7. The distribution of the spots in latitude in 1901 shows some tendency in the mean to seek a higher latitude than in 1900, four groups, two in each hemisphere, appearing in latitudes above 20° . But the relatively great area of the group of May 19, in N. lat. 9° , brings the mean distance from the equator of all spots down to $10^\circ.37$. This shows a distinct rise in latitude over 1900, when the mean distance was $7^\circ.74$. In the closing years of the preceding cycle the mean distance for 1888 was $7^\circ.39$, and for 1889, the year of minimum, $11^\circ.61$, whilst for 1890, the first year of increased spotted area, it was $21^\circ.99$.

8. The number of days without spots has very greatly increased, there having been no fewer than 289 such days out of the 359 days for which there are photographs available. On 277 days neither spots nor faculæ were shown on the photographs. The days for which the photographic record is deficient are January 13, January 24, February 27, April 3, August 3, and August 5.

9. The mean daily spotted area—twenty-nine millionths—for 1901 is much smaller than that for 1889, the year of the last minimum, which was seventy-eight; but it has not fallen quite so low as at the preceding minimum of 1878, when it was only twenty-four. The very slight activity in 1901, and the very large proportion of days on which no spots were seen, together with the appearance of four groups in latitude 20° or above, point to 1901 being probably the year of minimum. These four high latitude groups may, indeed, indicate the commencement of the revival, a view which receives some confirmation from the appearance on March 3 of the present year of two groups, one of them of considerable size, in N. lat. 25° .

1902 *March 11.*

Results of Micrometer Measures of Double Stars made with the 28-inch Refractor at the Royal Observatory, Greenwich, in the year 1901.

(Communicated by the Astronomer Royal.)

The measures were made with a bifilar position-micrometer on the 28-inch refractor, aperture 28 inches, focal length 28 feet. The power generally used was 670, but when the definition permitted a power of 1120 was employed for observing very close pairs. A blue glass shade was employed to diminish the light and irradiation when bright stars were observed. The observations were made in variously coloured fields or in a dark field with illuminated wires. The initials in the last column are those of the observers, viz. :—

B. Mr. Bryant. L. Mr. Lewis. W.B. Mr. Bowyer.

Micrometric Observations of Double Stars at the Royal Observatory, Greenwich.

Star's Name.	R.A. 1900. h m	N.P.D. 1900. ° '	Position Angle	Dis- tance.	No. of Nights.	Mags.	Epoch 1901.	Obs.
Σ 3062 ...	0 1	32 7	345°0	1"46	1	6.9 8.0	.753	B.
β 253 ...	0 5	32 2	42°5	0.52	2	8.3 8.4	.436	B.
β 485 ...	0 6	31 48	304°9	0.41	1	8.7 8.8	.753	B.
Krueger 1 ...	0 6	32 43	186°4	1.92	1	9.2 9.5	.753	B.
β 1026 ...	0 7	36 56	329°2	0.29	1	8.1 8.9	.753	B.
β 864 ...	0 8	55 13	283°9	1.14	1	8.4 11.5	.036	L.
0Σ 2 ...	0 8	63 34	37°4	0.68	1	6.5 8.0	.044	L.
			39°0	0.54	2	...	.853	W.B.
			36°0	0.60	2	...	.896	B.
Σ 19 ...	0 12	53 55	133°9	2.06	2	7.0 9.5	.022	L.
			135°5	2.22	1	...	.890	W.B.
β 1093 ...	0 15	79 34	70°7	0.28	1	7.3 8.2	.830	B.
β 1015 ...	0 16	78 14	113°9	0.49	1	8.4 8.6	.835	W.B.
0Σ 7 B.C.	0 16	24 5	107°4	0.54	1	9.0 10.0	.753	B.
β 1156 ...	0 21	26 7	34°5	0.45	1	9.2 9.3	.753	B.
0Σ 12 ...	0 26	36 2	147°1	0.42	1	5.6 5.9	.082	L.
			149°5	0.55	2	...	.436	B.
0Σ 15 ...	0 30	41 32	311°4	0.16	2	7.5 8.5	.436	B.
β 257 ...	0 35	43 17	229°9	0.46	1	8.1 8.8	.753	B.
0Σ 18 ...	0 37	86 23	128°4	1.07	1	7.4 9.5	.835	W.B.
β 865 ...	0 38	47 18	198°5	1.40	1	8.3 8.8	.753	B.
β 866 ...	0 40	47 18	69°1	1.70	1	9.0 9.1	.753	B.